REMARKS

This Amendment responds to the Office Action dated December 18, 2003 in which the Examiner objected to Figures 1 and 2, rejected claims 1-14 under 35 U.S.C. § 103.

Applicant would like to thank the Examiner for the personal interview on March 25, 2004.

Attached to this Amendment are annotated Figures 1 and 2 to label them prior art. Replacement copies will be provided when approved. Applicant respectfully requests the Examiner withdraws the objection to the drawings.

As indicated above, typographical errors in the specification have been corrected. Applicant respectfully requests the Examiner approves the corrections.

As indicated above, claim 1 has been amended to incorporate claim 4 and claim 8 has been amended to incorporate claim 11. Applicant respectfully submits that the amendment is unrelated to a statutory requirement for patentability.

Claims 1 and 8 claim a magnetoresistive effect thin-film magnetic head including a plurality of layers including a magnetoresistive effect multilayer in which a current flows in a direction perpendicular to surfaces of the magnetoresistive effect multilayer and an insulation gap layer. At least part of the insulation gap layer is made of Co-γFe_2O_3.

Through the structure of the claimed invention having at least part of an insulation gap layer made of maghemite, the claimed invention provides a magnetoresistive effect thin-film magnetic head in which the capacitance between the shield layers is reduced to improve the frequency characteristic of the magnetic

head. The prior art does not show, teach or suggest the invention as claimed in claims 1 and 8.

Claims 1-3, 5-10 and 12-14 were rejected under 35 U.S.C. § 103 as being unpatentable over Applicant's admitted prior art in view of *Lee* (U.S. Patent No. 4,195,323). In addition, claims 4 and 11 were rejected under 35 U.S.C. § 103 as being unpatentable over Applicant's admitted prior art as applied to claims 1 and 8 and further in view of *Soeya et al.* (U.S. Patent No. 5,435,777).

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. § 103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, Applicant respectfully requests the Examiner withdraws the rejection to the claims and allows the claims to issue.

Applicant's admitted prior art appears to disclose Fig. 2 illustrates a TMR element or a CPP-GMR element with a conventional structure, seen from the ABS. In the figure, reference numeral 20 denotes a lower shield layer also serving as an electrode, 21 denotes a lower gap layer made of a metal material, which also serves as an electrode, 22 denotes a TMR layer with a multi-layered structure consisting of a lower ferromagnetic thin-film layer (free layer) / a tunnel barrier layer / an upper ferromagnetic thin-film layer (pinned layer) / an anti-ferromagnetic thin-film layer, or CPP-GMR layer with a multi-layered structure consisting of a lower ferromagnetic thin-film layer (free layer) / a nonmagnetic metal layer / an upper ferromagnetic thin-film layer (pinned layer) / an anti-ferromagnetic thin-film layer, 23 denotes an upper gap layer made of a metal material, which also serves as an electrode, 24 denotes an upper shield layer also serving as an electrode, 25 denotes hard bias layers, and 26 denotes an insulation gap layer made of an insulating material, respectively.

Reference numeral 22a denotes extended parts of the lower ferromagnetic thin-film layer (free layer) extending from the TMR multilayer or the CPP-GMR multilayer to the hard bias layers 25 along the surfaces of layers of the TMR multilayer or the CPP-GMR multilayer. The TMR element or CPP-GMR element is electrically connected between the lower shield layer 20 and the upper shield layer 24 so that a sense current flows in a direction perpendicular to the surfaces of the layers. As shown in Fig. 4, the TMR element or the CPP-GMR element that utilizes the shield layers as the electrodes has not only an equivalent resistance RTMR of the TMR element or the CPP-GMR element across their output terminals but also a capacitance C_{shield} between the shield layers and a capacitance CTMR of the TMR element or the CPP-GMR element itself across their output terminals. These resistance RTMR and capacitances CTMR and Cshield form a low-pass filter causing serious deterioration of the frequency characteristics.

Thus, Applicant's admitted prior art merely discloses a CPP-GMR element. Nothing in the admitted prior art shows, teaches or suggests that at least part of an insulation gap layer is made of maghemite as claimed in claims 1 and 8.

Lee appears to disclose a thin film magnetic type of read/write transducer head as used in high speed applications for data sensing relative to record media such as tapes, drums, disks and the like. (col. 1, lines 13-16) During formation of magnetoresistive head 60, the substrate 62 is first overlaid with a first deposition surface 64 of insulator material that is non-magnetic in character and of hard dielectric quality. Such insulated material may be such as $AL_2 O_3$, Si_3N_4 or other oxides of silicon, all materials having requisite properties that are easily deposited and conducive to various etching techniques. Or, in the case of silicon substrate, the

initial surface can be heat treated in an oxidizing atmosphere to form a layer of silicon dioxide, a well known art in the semi-conductor industry. Next is deposited a read shield 66, a multi-layer magnetic structure that is made up of an even number of pairs of Nickel-Iron thin film with a thin SiO_2 or Titanium film layer in alternation. (col. 3, line 66 through col. 4, line 11) Accordingly, shield 66 is then finally formed by the stacking of a plurality of such pairs of thin films 70, as successively applied by deposition and as separated by intersticed formations 68. (col. 4, line 25-28) Relatively thin film of insulator 72 (see FIG. 4) is then deposited over the shield 66, and the insulator once again may be Al_2O_3or the well-known glass compositions including SiO_2 and related silicates and silicon nitride. A magnetoresistive (MR) sensor 74 is then deposited to overlay the shield 66 in insulatively spaced disposition. Sensor 74 consists of a deposition of magnetoresistive material, such as NiFe alloy, and suitable conductive contact layer is formed in extension, as at 76 and 78, to receive electrically conductive contact with plated conductors 80 and 82. (col. 4, lines 36-46) The next thin film of insulator material, e.g., the similar glass or glass-like materials as previously specified, is deposited across conductors 80 and 82 and the MR sensor 74. This surface then receives deposition of a bias thin film 86 which consists of a thin film deposit of suitable permanent magnet material such as Alnico or other high remanence alloy. Another deposition of insulator 88 then overlays bias thin film 86 to receive deposition in properly spaced manner of a shield pole 90 which may be identical to the pole 66 as shown in enlarged form in FIG. 5. (col. 4, lines 55-67) The shield pole 90 is also then overlaid with an insulator film 92 of the same type previously used, to receive deposition of a write conductor 94 as disposed for inductive coupling to its associate write poles. A final insulative thin film 96 is

then applied to receive thereon a trailing edge pole 98 of the multi-layer thin film type. Thus, trailing edge pole 98 also consists of a stack of magnetostatically coupled pairs of NiFe thin films 102-102n; however, the thickness and arrangement is altered in order to shape the write field of the unit. (col. 5, lines 3-16) The read and write conductors are shown generally as being sputtered and plated on the sides of recording head 60. In FIG. 4, the write conductors 110 and 112 and read conductors 114 and 116 may be formed by any of several acceptable integrated circuit techniques to provide the proper conductor continuity, shown generally for write conductor 94 by dash lines 118 and 120, and for read conductor 80 and 82 by means of dash lines 122 and 124. (col. 5, lines 41-49)

Thus, *Lee* merely discloses the CIP-GMR head in which the current flows in parallel to the surfaces of the layers. Nothing in *Lee* shows, teaches or suggests a) a magnetoresistive effect multilayer in which a current flows in a direction perpendicular to surfaces of layers of the magnetoresistive effect multilayer or b) at least a part of an insulation gap layer is made of maghemite as claimed in claim 1. Rather, *Lee* merely discloses a CIP-GMR head.

Soeya et al. appears to disclose a magnetoresistive head has a substrate (1) and, on the substrate, a magnetoresistive film (40) for converting a magnetic signal into an electric signal by using magnetoresistance effects and a pair of electrodes (60) for causing a signal detection current to flow through the magnetoresistive film. A pair of first domain wall suppressing layers (30) are arranged at opposite end portions of the magnetoresistive film, respectively, to apply a longitudinal magnetic bias to the magnetoresistive film. A second domain wall suppressing layer (45) is also provided for applying a longitudinal magnetic bias, which is weaker compared

with the longitudinal magnetic bias applied by the first domain wall suppressing layers, to the magnetoresistive film (40). (abstract) As the second domain wall suppressing layer 45 is interposed between the magnetoresistive film 40 and the shunt film 50, an antiferromagnetic material such as a semiconductor or insulator, for example, nickel oxide or hematite is not used. If these materials should be used, the magnetoresistive film 40 is electrically insulated so that a sufficient current is not allowed to flow through the magnetoresistive film. (col. 8, lines 57-65)

Thus, *Soeya et al.* merely discloses hematite. Nothing in *Soeya et al.* shows, teaches or suggests at least a part of an insulated gap layer is made of maghemite as claimed in claims 1 and 8.

Since nothing in Applicant's admitted prior art, *Lee* or *Soeya et al.* show, teach or suggest the invention as claimed in claims 1 and 8, Applicant respectfully requests the Examiner withdraws the rejection to claims 1 and 8 under 35 U.S.C. § 103.

Claims 2, 6-7, 9 and 13-14 depend from claims 1 and 8 and recite additional features. Applicant respectfully submits that claims 2, 6-7, 9 and 13-14 would not have been obvious within the meaning of 35 U.S.C. § 103 over the references at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 2, 6-7, 9 and 13-14 under 35 U.S.C. § 103.

The prior art of record, which is not relied upon, is acknowledged. The references taken singularly or in combination do not anticipate or make obvious the claimed invention.

Thus it now appears that the application is in condition for reconsideration and allowance. Reconsideration and allowance at an early date are respectfully requested.

If for any reason the Examiner feels that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed within the currently set shortened statutory period, applicant respectfully petitions for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

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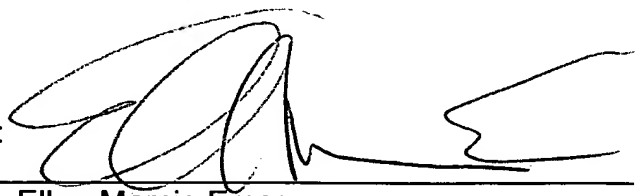
Date: April 14, 2004

By: 

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